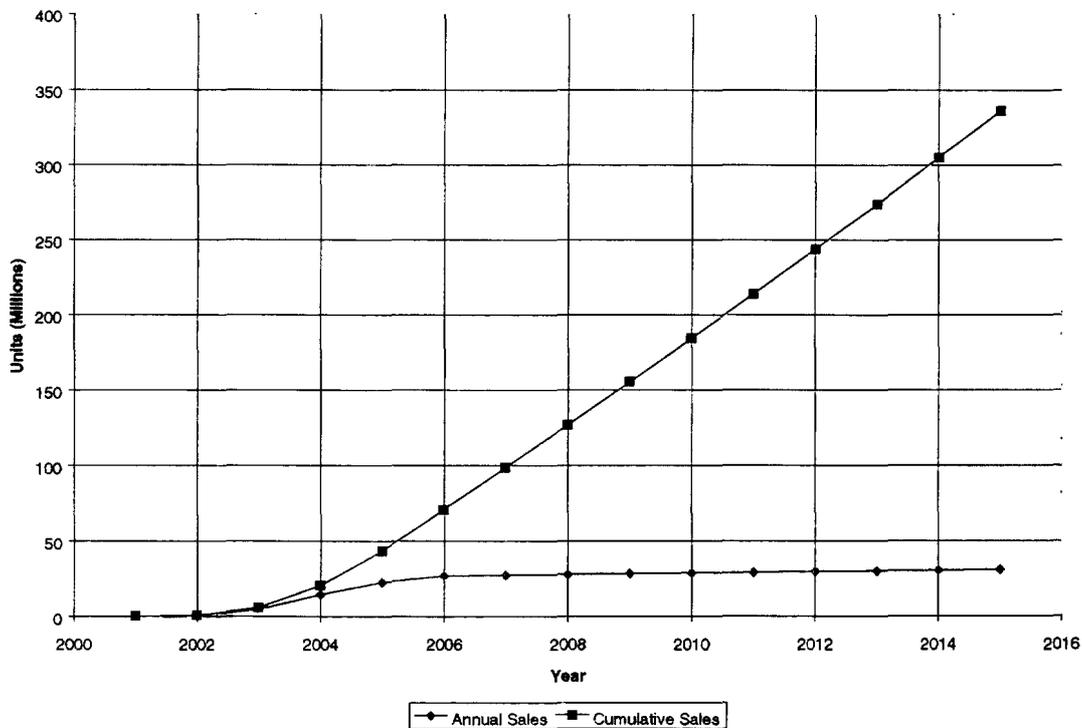


### 5.3.5 Phased-Mandate Scenario

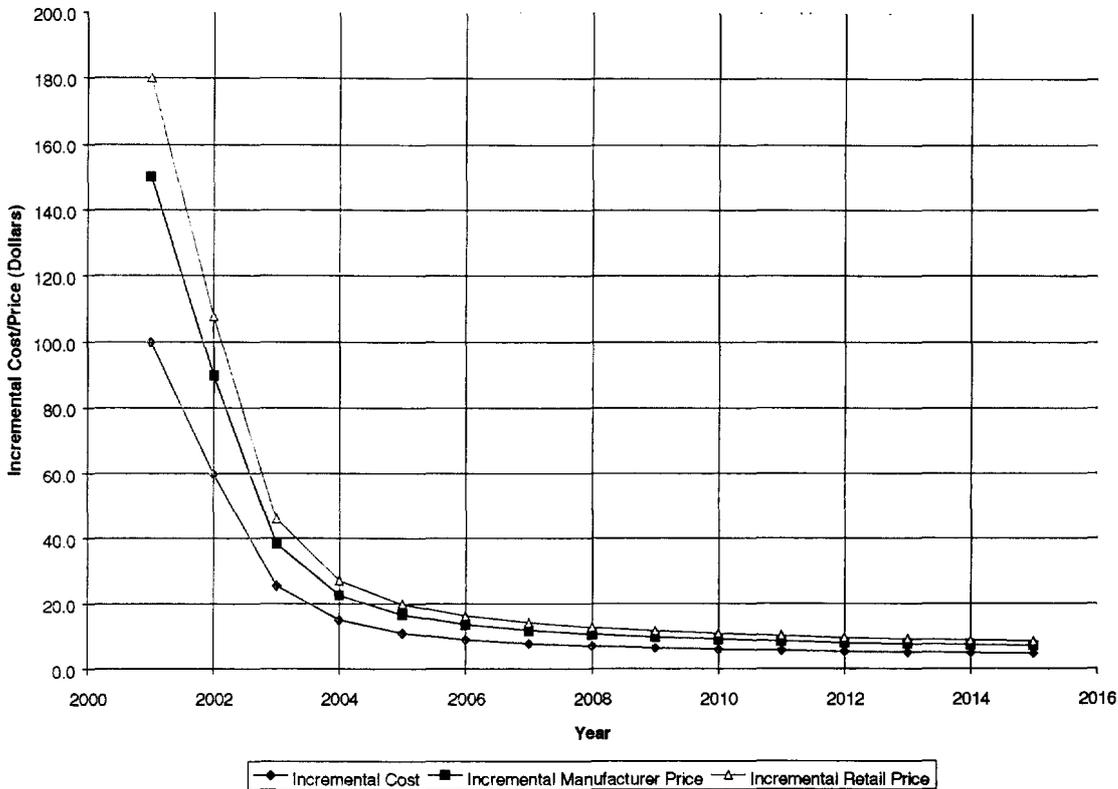
The final scenario considered assumes a phased-mandate starting in year 2003 requiring sets 32 inches and larger to be capable of receiving digital television, and expanding the mandate over time to include smaller sets until it covers all receivers by 2006. The resulting estimates of DTV adoption are presented in Figure 5-18.

Figure 5-18 Estimated DTV Adoption under Mandatory Phased Scenario



In this scenario, the cost curve and the corresponding manufacturer/retail price estimates are as presented in Figure 5-19.

**Figure 5-19 Estimated Cost and Price Impact under Mandatory Phased Scenario**



Assuming the FCC institutes a mandate for phased DTV implementation, the cumulative DTV sales are projected to reach nearly \$70.8 million in year 2006. Based on an assumption of 109.3 million U.S. households owing TV sets in 2006 [Carmel Group, 2001], the DTV household penetration rate would be 65% which is lower than the FCC's 85% target penetration for that date. The target penetration rate is reached by 2007 under this scenario.

In this scenario, the incremental cost of implementation is projected to decrease from \$100 in 2001 to \$9 in 2006. The corresponding incremental retail price would be approximately \$16 in 2006.

**5.3.5.1 Summary of Results for Phased Mandate Scenario**

The results obtained for the mandatory phased implementation of DTV are presented in Table 5-3.

**Table 5-3 Summary of Results for FCC Phased Mandate Scenario**

Year	Phased-in Schedule	Annual DTV Sales (million units)	Cumulative DTV Sales (million units)	Incremental Cost/Unit (\$)	Incremental Retail Price/Unit (\$)	US TV Households*	US Household DTV Penetration Rate
2001	N/A	0.21	0.21	100.00	180.0	104.0	0.2%
2002	N/A	0.52	0.73	59.84	107.7	105.0	0.7%
2003	All 32" & above	4.97	5.70	25.53	46.0	106.0	5.4%
2004	All 25" & above	14.86	20.56	14.99	27.0	107.1	19.2%
2005	All 19" & above	22.89	43.45	10.99	19.8	108.2	40.2%
2006	All 13" & above	27.34	70.79	8.97	16.2	109.3	64.8%
2007	N/A	27.75	98.53	7.82	14.1	110.3	89.3%
2008	N/A	28.16	126.70	7.05	12.7	111.4	N/A
2009	N/A	28.58	155.28	6.48	11.7	112.5	N/A
2010	N/A	29.01	184.29	6.03	10.9	113.6	N/A
2011	N/A	29.45	213.74	5.67	10.2	114.8	N/A
2012	N/A	29.89	243.63	5.37	9.7	115.9	N/A
2013	N/A	30.34	273.97	5.12	9.2	117.1	N/A
2014	N/A	30.79	304.77	4.90	8.8	118.3	N/A
2015	N/A	31.26	336.02	4.70	8.5	119.4	N/A

In Table 5-3, the key results are presented for the case of a phased mandatory implementation scenario. In this figure, the shaded area indicates the 'phase-in' period, beginning in 2003 and ending in 2006, the year the FCC has specified as a target date for 85% household penetration. Under this scenario, the penetration in 2006 will be 65% and the FCC's penetration goal will not be achieved until 2007. Similarly, the penetration rates in 2008 and later are not calculated in the table due to multiple DTV sales to one household may start since then.

#### **5.4 Integrated HighEnd Model DTV**

In this section, the integrated DTV analysis is presented for a HighEnd model (i.e. Case B in figure 2-3) SDTV. Rather than repeat the analysis of the previous section for a leader model TV, we note that the incremental costs and prices of a HighEnd SDTV can be estimated by simple adjustments to the previous section.

For the purpose of this analysis, we assume that a typical HighEnd SDTV would include a number of the DTV components shown in the Figure 3-3 block diagram of a DTV. Since these components are already included in the basic cost (and price) of the set, they are not counted as incremental costs to the end consumer to enable fully compatible ATSC reception.

A HighEnd TV would normally be a most expensive model with a larger screen size and might, for example, include internal digital signal processing to add such features as: picture-in-picture, line doubling resolution enhancement, and noise averaging. In order to implement such features, a HighEnd TV would require analog to digital to analog signal conversion and processing as well as significant memory for frame storage and buffering. With reference to the several cost estimates shown in this report (for example, see the Table 4-4 Summary costs provided by

Thomson), we roughly estimate that half of the total costs of implementation of ATSC compatibility is already included in a HighEnd TV.

However, the markups between direct material costs to factory prices and retail prices are different for a HighEnd TV versus a leader model TV. As previously indicated, while a typical markup between costs and manufacturer prices for a leader model are on the order of 1.5X, the markup for a HighEnd TV would be more on the order of 2.0X to 2.5X. Furthermore, while the retail margins for a leader set might be on the order of 20%, the retail margin for a HighEnd set would be in the vicinity of 35%. This leads to the following adjustments between the leader model and the high-end set incremental costs and prices.

For a High-end set:

$$\begin{aligned} \Delta HE_{dm} &= \Delta LM_{dm} \times 0.5 && \text{(High-end set has 50\% of the incremental direct material cost as that of a leader model)} \\ \Delta HE_{mp} &= \Delta HE_{dm} \times 2.5 && \text{(Markup of 2.5X for manufacturer prices on a high-end TV receiver)} \\ \Delta HE_{rp} &= \Delta HE_{mp} \times 1.35 && \text{(Markup of 1.35X for retail prices on a high-end TV receiver)} \end{aligned}$$

$$\text{Or } \Delta HE_{rp} = 1.69 \times \Delta LM_{dm};$$

For a leader model:

$$\begin{aligned} \Delta LM_{mp} &= \Delta LM_{dm} \times 1.5 && \text{(Markup of 1.5X on manufacturer prices of a leader model receiver)} \\ \Delta LM_{rp} &= \Delta LM_{mp} \times 1.20 && \text{(Mark up of 1.2X on retail prices of a leader model)} \end{aligned}$$

$$\text{Or } \Delta LM_{rp} = 1.8 \times \Delta LM_{dm}$$

Where:

- $\Delta LM_{dm}$  = the incremental direct material costs to add standard definition DTV capability to a leader model TV receiver
- $\Delta LM_{mp}$  = the incremental manufacturer prices to add standard definition DTV capability to a leader model TV receiver
- $\Delta LM_{rp}$  = the incremental retail prices to add standard definition DTV capability to a leader model TV receiver
- $\Delta HE_{dm}$  = the incremental direct material costs to add standard definition DTV capability to a high-end TV receiver
- $\Delta HE_{mp}$  = the incremental manufacturer prices to add standard definition DTV capability to a high-end TV receiver
- $\Delta HE_{rp}$  = the incremental retail prices to add standard definition DTV capability to a high-end TV receiver

The incremental manufacturing cost, incremental manufacturer price and incremental retail price ratios between a high-end set and a leader model are summarized as follows:

$$\Delta HE_{dm} = 50\% \times \Delta LM_{dm}$$

$$\Delta HE_{mp} = 83\% \times \Delta LM_{mp}$$

$$\Delta HE_{rp} = 94\% \times \Delta LM_{rp}$$

## **5.5 Set-top box**

With over 100 million TV households and an average of 2.5 television sets per household, there are currently over 250 million analog televisions in the US. Based on the sales projections of integrated DTVs, many of these sets will not be replaced for 10 or more years. In fact, even under the most optimistic DTV penetration scenario, there might still be 100 million analog televisions in use by 2010.

Consumers are likely to extend the life of many of these sets by attaching a “transverter” or a set-top-box that enables a standard NTSC analog television to receive and view DTV. It is assumed that the typical transverter will be capable of receiving all 18 modes of DTV and will convert whatever mode received to SDTV 480I. The typical transverter may also be capable of receiving and converting “basic” (i.e. non-scrambled) digital cable channels thus it will be “cable-ready”. This typical configuration will serve as our “reference” design in this analysis

### **5.5.1 Market Projection for Transverters**

There are two cases under which a consumer might consider the purchase of a transverter:

- To extend the useful life of an otherwise good analog NTSC television; and,
- When purchasing a new television, and a package consisting of a new analog television plus a transverter is more cost effective or better suits the consumers needs than any integrated DTV. (This would probably only be the case if the consumer were forced to consider a higher-end model as their first-choice model is not available with an integrated DTV receiver).

The existence and size of both of these market segments are dependent upon the cost of a transverter relative to that of an integrated DTV. In the former case, the consumer will compare the cost of adding a transverter to that of a replacement integrated DTV television. In the latter case, the consumer will consider the convenience of an integrated set (and other incremental features) to the cost differential between an integrated DTV set and a transverter/TV package. In the event the FCC issues a mandate to include a digital receiver in all televisions above a certain size, the consumer in the market for a new TV that falls under the mandate will not have the option of a transverter/TV package.

### ***5.5.2 Digital Satellite Set top box costs***

In 1994, DirecTV began offering digital satellite service. At that time RCA Thomson was the only supplier of the DirecTV set top box which sold retail for \$799 per set. Today there are many suppliers of DirecTV boxes offering many models from the most basic to HDTV boxes that also receive terrestrial HDTV signals and boxes with integral PVR features.

Since the inception of digital direct-to-home (DTH) satellite television in the United States in 1994, the number of subscribers has grown to approximately 16 million as of today. With churn currently at approximately 0.7% per month, and assuming that only a small portion of those set-top-boxes are reused, the cumulative number of boxes manufactured for DirecTV and Echostar stands at approximately 21 million. Add to this, the boxes manufactured for Primestar and Alphastar, the total is in the range of 25 million.

Based on a learning curve factor of 75% (or 25% cost reduction) for each cumulative doubling of volume, the current retail price of a DTH set-top-box should be approximately \$170. Since DirecTV, Echostar and Primestar each use different approaches to signal transmission, it is possible that the learning factor would be lower. Much of the technological content of these boxes is, however, common with boxes manufactured for non-US DTH systems and other electronic devices. For example, MPEG chip sets, synthesized tuners, smart cards and smart card readers, remote controls, modulators, etc. are common among all DTH set-top-boxes. MPEG chip sets are found in many other consumer products such as DVB players, digital video recorders and personal computers. And remote controls are found today on stereos, air conditioners, fans, lighting systems, alarms, etc. These components are reaching significantly higher manufacturing volumes from application to other consumer electronic appliances, further lowering the manufacturing cost of DTH set-top boxes. Additionally, it is reasonable to expect that the manufacturing and retail markups have decreased due to significant competition.

Currently the unsubsidized retail cost of DTH boxes range from over \$400 down to a low of \$79, with the most popular models averaging around \$150 (based on a simple survey of prices conducted by ADL). These prices are in general agreement with the learning curve theory offered previously.

### ***5.5.3 Set top box costs***

Many of the major components that make up a typical transverter design are essentially the same as those found in DTH satellite set-top-boxes, integrated DTVs and other consumer electronics devices. Figure 5-20 below illustrates the major components that are present (shaded areas) in a satellite STB, a transverter and a DTV receiver. From this, it can be seen that large portions of the design and content are common across these devices.

Figure 5-20 Common Components across DTV Products

Component	Satellite STB	Transverter	Integrated DTV*
MPEG decoder			
MPEG Multiplexer			
RF Modulator			
Remote Control			
Housing			
Power supply			
Synthesized Tuner			
Smart card			
Smart card reader			
Conditional Access			
Antenna			
LNB			
QPSK demodulator			
8-VSB demodulator			
QAM demodulator			
Echo Canceling			

\* Considering only those additional components needed to add DTV to an analog design.

That is, in comparison to a satellite STB, the transverter does not include an antenna (although a special antenna may be required to receive terrestrial DTV, it is unlikely to be bundled with the transverter as is the case with a DTH receiver), LNB, smart card or conditional access components. It does require additional signal processing for echo or ghost canceling. The latter is also required in the integrated DTV receiver and is handled largely in semiconductors designed specifically for that application.

Analog NTSC addressable cable set-top boxes currently cost approximately \$100 and we anticipate that expect that they will remain at this price point throughout the study period. Given the technological content of the analog set-top box it is reasonable to assume that inclusion of a DTV receiver will initially cost \$100 and that this incremental cost will fall relative to the same manufacturing learning curve associated with DTV sets. That is, given the technological similarities between SDTV set-top transverter, digital satellite Set-top boxes, and DTV receivers, the set-top transverter is expected to benefit from the same manufacturing volumes and learning curve, associated with these other products. Therefore, the cost of a transverter is expected fall in relation to that of the integrated DTV receivers. The SDTV set-top transverter total cost and retail price decline is shown in Figure 1-4.

Applying this approach, the initial cost of a set-top transverter is expected to be in the range of \$200 in 2001 (\$100 for an analog cable set-top box and an additional \$100 to incorporate a DTV receiver) leading to a manufacturing price of \$300 (1.5 times manufacturer's markup) and a retail price of \$360 (1.2 times retailer's markup). As in DTV receiver free market adoption baseline scenario, the cost of a set-top transverter would be expected to decline following the same learning curve shown in Figure 5-7. So that, by 2006, for example, the total costs would decline to \$121 (i.e. \$100 per set-top box plus \$21 for the DTV reception additional cost by 2006

based on Figure 5-7). This would result in a manufacturing price of \$182 (1.5 times total cost of \$121) and retail prices of \$218 (1.2 times \$182) by 2006.

Under the FCC mandate scenarios however, the total cost of a transverter could be dropped to as low as \$108.4 (i.e. \$100 for an analog set-top box and \$8.4 for a digital receiver) by 2006. This will lead to a manufacturing price of \$162.6 and retail price of \$195.

This estimate of \$218 by 2006 for a set-top transverter is somewhat higher than today's \$150 for a mature digital DTH satellite STB. For the reasons explained above, we would expect that the actual costs would likely fall somewhere between these two alternative means of estimation of retail prices.

## 6 Conclusions

### 6.1 Summary of Results

The above analysis in Section 5 above has estimated the unit sales for digitally enabled television under three scenarios. These results are summarized in Figure 6-1 and Figure 6-2.

Figure 6-1 Estimated DTV Cumulative Sales under Study Scenarios

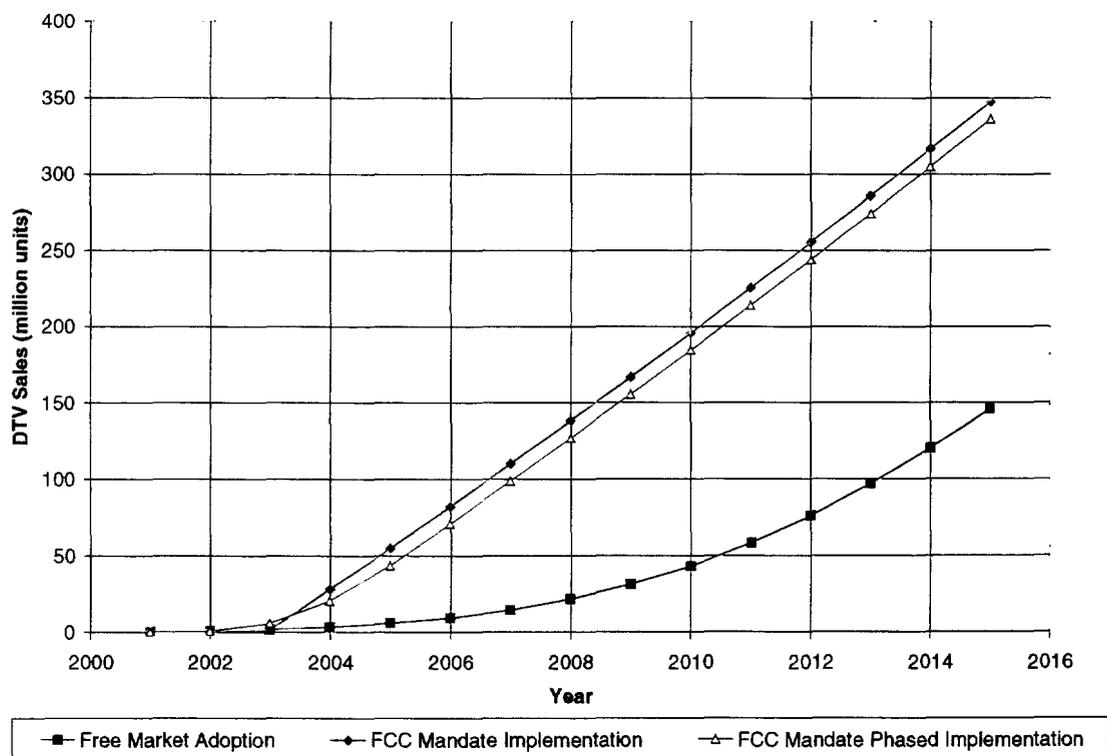
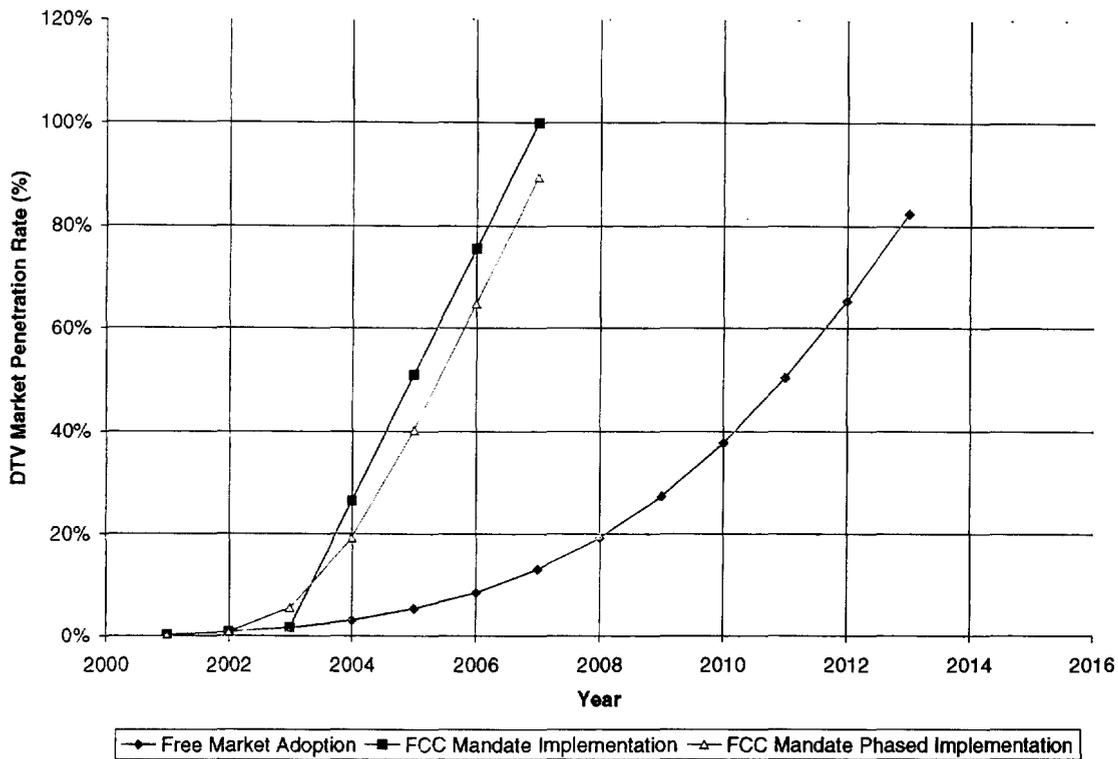


Figure 6-2 DTV Market Penetration Rate Under Study Scenario



We have also compared DTV market penetration under the Bass Adoption baseline scenario with the adjusted forecast numbers from CEA [CEA, 2001a] for the next 6 years as shown in Figure 6-3. We obtained the CEA adjusted integrated DTV sales forecast by applying 20% on the CEA projected DTV sets and display sales. (Note: Twenty-percent (20%) is the ratio of integrated DTV sales over the CEA forecasted DTV sets and display sales numbers. [CEA, 2001d]) (As shown in Figure 4-1). The two forecasts are in general agreement especially in the initial 3 years with the CEA adjusted forecasts a little bit higher. Since 2003, the Bass Adoption projection exceeds the CEA adjusted numbers with 2.6 million sets higher in 2006. The major differences between these two forecasts are believed to be related to different forecast methodologies and assumptions applied.

Figure 6-3 Bass Adoption Baseline Case Forecast and CEA Forecast DTV Penetration Comparison

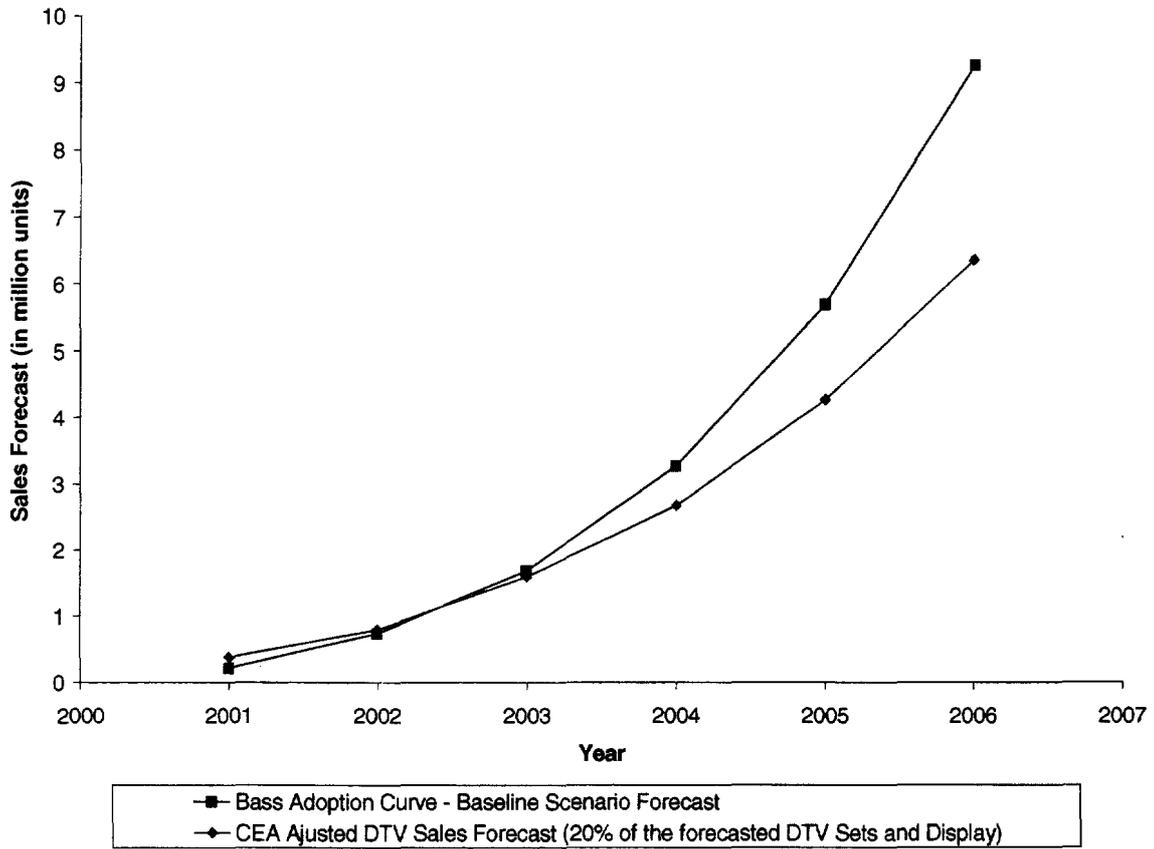
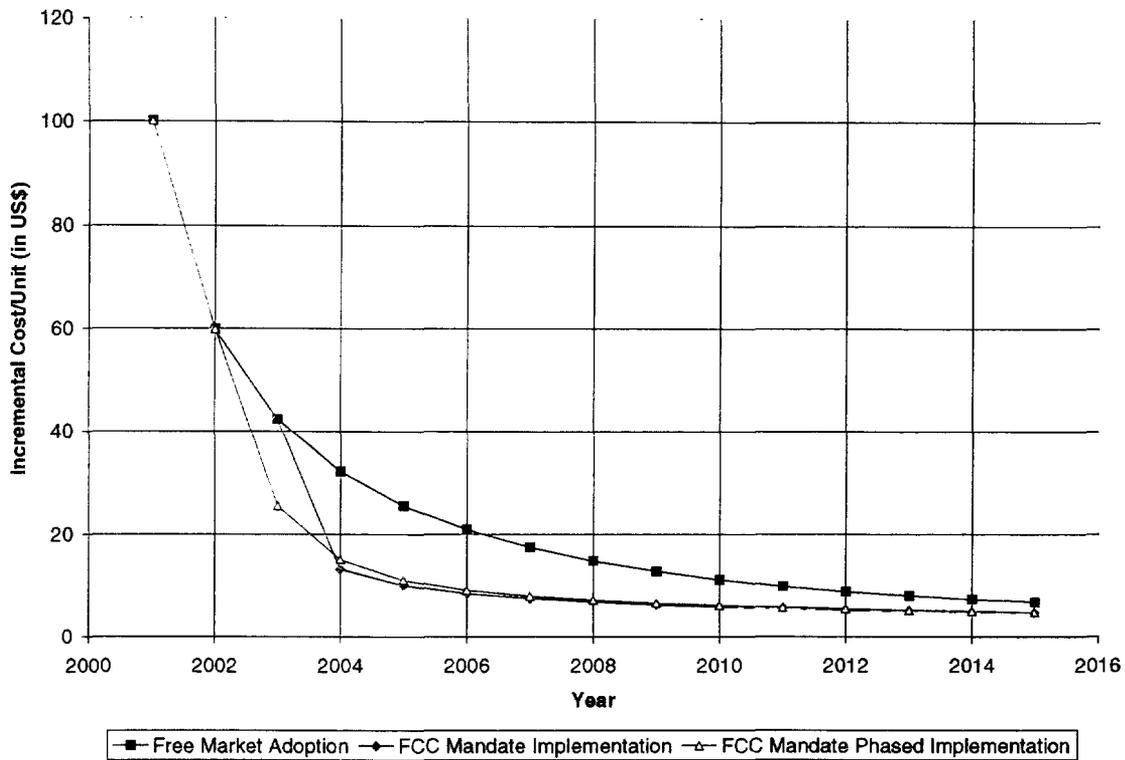


Figure 6-4 presents the corresponding cost-impact curves for each of the three study scenarios.

Figure 6-4 Incremental Cost Impact under Study Scenarios



## 6.2 DTV Market Penetration

Based on the above analysis, a number of observations and conclusions may be reached:

- Free Market Adoption Scenario - Assuming free market adoption without governmental influence, cumulative DTV sales are projected to grow to approximately 9.3 million units by 2006. The corresponding penetration is projected to reach only 8.5% by 2006 (assuming 109.3 million TV households [Carmel Group, 2001a] in 2006, and that each DTV sale represents a new adopting household). This is well below the FCC target of 85% by this date. According to these projections, the FCC penetration target would not be reached until 2014 or later in this baseline scenario.
- FCC Mandate Scenario - Assuming the FCC were to institute a full government mandate beginning 2004, cumulative DTV sales are projected to increase substantially relative to the baseline scenario. According to our projections, DTV sales would grow to approximately 82.5 million units by 2006. This implies that 75.5% of US households would have DTV reception capability by 2006. The FCC target of 85% penetration could be reached in 2007 under this scenario.

- Phased Mandate Scenario - Assuming the FCC were to require a phased introduction beginning in 2003, cumulative sales are projected to reach approximately 71 million by 2006, with a corresponding 65% DTV penetration by 2006. The 85% FCC target penetration rate could be reached in 2007 under this scenario.

### **6.3 Manufacturing Learning Curve**

Impact of the manufacturing “Learning Curve” on the incremental cost to manufacture DTV capable receivers as well as on the retail price to consumers has been examined. That is, as the cumulative number of manufactured units increases, the cost to manufacture these products falls exponentially due to the availability and decreasing cost of integrated components and improvements in manufacturing processes.

Under all scenarios, the incremental material cost will be approximately \$100 initially in 2001. Adjusted for typical manufacturing and retail markups, this corresponds to a \$180 retail price increase in a leader model television set to the consumer.

Specifically:

- Under the free market adoption (baseline) scenario, the incremental material cost to enable DTV reception is projected to gradually decrease from \$100 to approximately \$21 by the year 2006. Adjusted to reflect typical manufacturing and retail markups, the incremental price to consumers is projected to decrease from \$180 initially to \$38 by 2006.
- Under the mandate scenario, the incremental material cost is projected to decrease more rapidly due to increased DTV sales beyond 2004. The \$100 incremental material cost is projected to decrease to approximately \$8.4 by 2006, which corresponds to a projected retail price increase of approximately \$15.
- Under the mandatory phased implementation, the incremental material cost is projected to decrease from an initial \$100 to \$9 by 2006. The corresponding incremental retail price is estimated to be \$16.

### **6.4 Summary of Cost/Price Analysis**

#### **6.4.1 SDTV Receivers**

This analysis focused on four study “cases” consisting of two market segments – “market leader” televisions and “high-end” televisions, under two scenarios – “FCC mandate” and “free market” adoption (See Figure 3-1).

The results of the cost/price analysis over time for each of these cases are summarized in . As can be seen, the government mandate scenario will bring down the costs to customers more

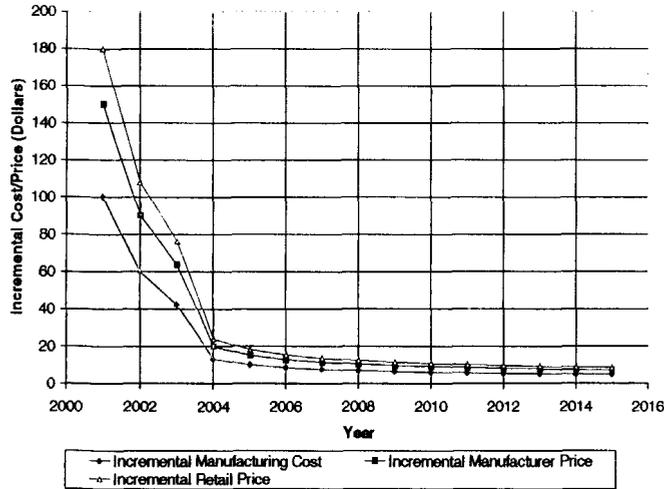
rapidly, which is due to increased unit sales and greater manufacturing efficiencies. This applies to both leader models and high-end sets. High-end models typically require about half of the incremental cost to add a DTV receiver as compared to a leader (low-end) TV set, since high-end sets already include some internal digital signal processing and memory components to support such features as picture-in-picture, line doubling resolution enhancement, etc. On the other hand, high-end sets normally have a higher manufacturer price markup (2.5X the direct material cost compared to 1.5X for the leader models) and a higher retail profit margin (30% compared to 20%, respectively). This translates to the incremental retail price for a high-end model of approximately 94% of the retail price increase for a leader model.

As an example, the incremental direct material cost and corresponding retail price increase to incorporate a DTV receiver for a low-end set in 2001 is \$100 and \$180 respectively, and will decline to \$21 and \$38 respectively by 2006 under the free market rollout scenario. The comparable incremental cost and price for a high-end model is therefore around \$50 in incremental material cost and \$169 in retail price increase in 2001, expected to fall to \$11 and \$35 by 2006.

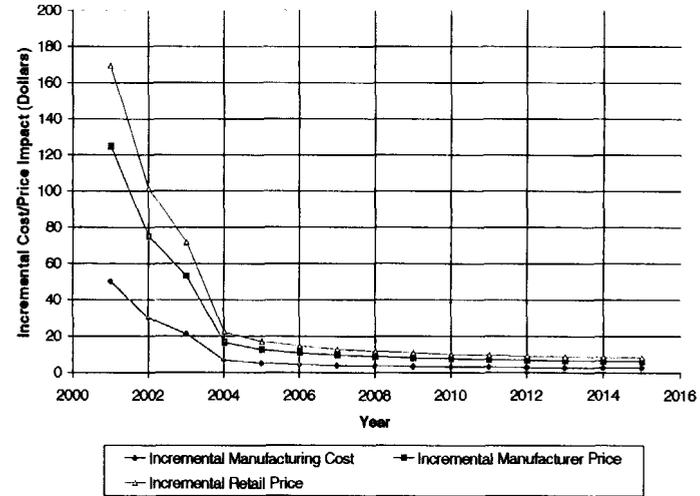
Figure 6-5 SDTV Receiver Cost/Price Analysis

Case 1:  
Government  
Mandates  
100% DTV

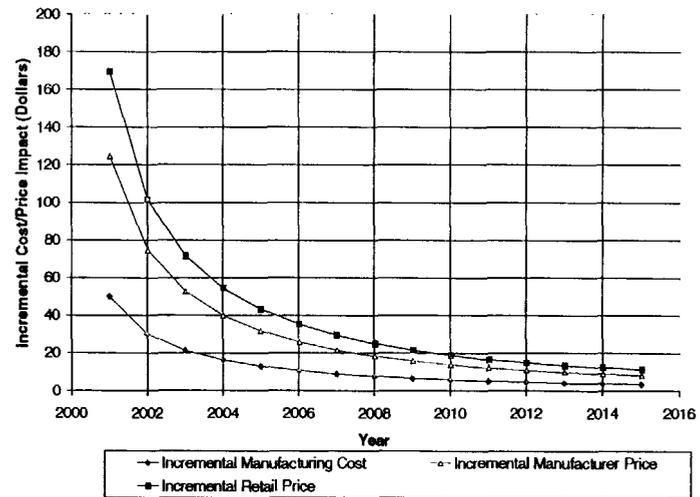
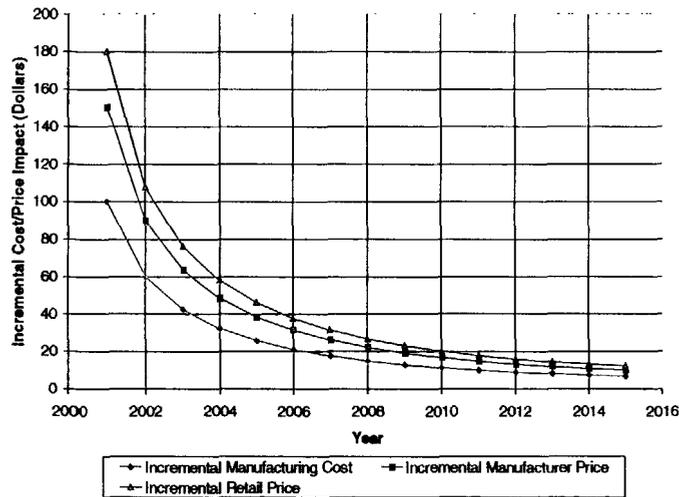
Case A: Leader



Case B: HighEnd



Case 2:  
Marketplace  
Decides  
Volume  
Rollout



### **6.4.2 Set-top Transverter**

The manufacturing cost and retail price of set-top transverters were also assessed. These devices enable existing analog TVs to receive digital ATSC television.

The SDTV set-top transverter total cost and price decline is shown in . This is based on the current cost of an analog NTSC addressable cable set-top box (\$100 throughout the study period), plus the same \$100 incremental cost to add a digital receiver to a television (in year 2001). As described further in Section 5.5, "Set-top Box", SDTV set-top transverters will also be subject to learning curve efficiencies and cost reductions in relation to the volume of other digital receiver products manufactured over time due to the similarities between SDTV set-top transverters, satellite Set-top boxes, and DTV receivers.

### **6.5 Major Uncertainties**

Recognizing that there is significant uncertainty in various model inputs and assumptions, it is important to realize that various factors can significantly affect the estimates presented in this report. Several key factors affecting the results include the following:

- ***Free market vs. Government Mandate of DTV Receivers***

The single factor with the greatest potential impact on DTV adoption that we now face is that of FCC policy yet to be defined relative to DTV. As can be seen from this analysis, the results based on the free market adoption scenario differ significantly from the results gained under the FCC mandated scenarios. That is, cumulative DTV sales, market penetration and the incremental cost to incorporate DTV receivers in newly manufactured sets, are all very sensitive to the course chosen by the FCC. This is the most important factor having the greatest potential impact on these factors.

- ***Price Elasticity and Market Adoption***

The purchasers of low-end ("leader") TV sets are expected to be more price sensitive than buyers of more expensive, higher-end sets. Therefore, the sales projections of integrated DTVs in the initial years may be substantially lower due to price elasticity effects which have not been considered in this analysis.

That is, the initial \$180 retail price increase for the inclusion of a DTV receiver could substantially impact purchasing decisions regarding low-end sets. We learned from the interviews we conducted with a manager of a leading consumer electronics store, that "consumers of 'leader' sets are not likely to pay more than \$60 premium for inclusion of a digital receiver".

The manufacturing cost learning curve suggests that the incremental retail price for inclusion of a digital receiver will not fall to \$60 until 2004 under the free market adoption case, and under the government mandate scenarios it will not reach \$60 until 2003.

Prior to this time, sales of low-end 'leader' models can only be explained by the behavior of 'early adopters' who will pay a significant premium to have the latest product advancements. There is a risk that sales in these early years will not reach the projected level. Changes in the cumulative sales would impact the manufacturing learning curve pushing the estimated cost reductions and sales projections further into the future.

- ***Forward Pricing***

Should the manufacturer adopt a Forward Pricing strategy, the retail prices may be dramatically lower in the initial years of introduction. This approach could significantly fuel a more rapid acceptance and adoption of DTV receivers than indicated by our projections, resulting in faster cost reductions.

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MMDS or LLDS: Multichannel Multipoint Distribution Service (MMDS), Local Multipoint Distribution Service (LMDS). Both utilize microwave radio transmitters that are essentially 'line-of-sight' and basically differ only in the frequency and bandwidth spectrum utilized.

Motorola, News Release, 11/2000

MSTV, NAB: MSTV represents nearly 400 local television stations on technical issues relating to analog and digital television services. NAB serves and represents the American broadcast industry as a nonprofit incorporated association of radio and television stations and broadcast networks.

Nielsen Media Research, National Cable & Telecommunications Association, 5/2001

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## **APPENDICES**

## A. Supporting Data

This appendix provides key data employed in this analysis. The tables presented here represent the data supporting the plots presented in the main report and indicate the source of the data.

**Table A-1 U.S. Sales of Digital TV Sets and Displays to Dealers**

<u>US Digital TV Sets and Display* Sales Forecast</u>									
(in million sets)	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>
Annual Sales to Dealers	0.014	0.121	0.65	1.125	2.1	4	5.4	8	10.5
Cumulative Sales to Dealers	0.014	0.135	0.785	1.91	4.01	8.01	13.41	21.41	31.91

\* Includes direct-view and projection DTVs with integrated digital decoders and stand-alone DTV displays.  
 Source: Consumer Electronics Association (CEA), 2001

**Table A-2 U.S. HDTV Product Shipments**

<u>US HDTV Product Shipment</u>					
	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>
Product Shipment (in million sets)	0.604	1.865	3.71	6.04	9.975

(Source: Cahner In-Stat, 1/01)

**Table A-3 U.S. DTV Receiver Sales Forecast**

<u>US DTV Receiver Sales Forecasts</u>									
(in millions)	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>
Annual Shipments	0.05	0.13	0.29	0.47	0.75	1.2	1.7	2.4	3.4
Cumulative Shipments	0.05	0.18	0.47	0.94	1.69	2.89	4.59	6.99	10.79

(Source: Strategy Analytics, 12/98)

**Table A-4 U. S. Digital TV Subscribers**

<u>Digital TV Subscriber Forecast</u>								
(number of users, in millions)	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>
DTV - Terrestrial Subs	0	1.492	3.506	5.213	7.181	8.34	8.991	9.454
DTV - Cable	0.012	1.273	3.031	5.347	8.298	11.935	16.361	21.869
DTV - Satellite	6.552	8.256	10.042	11.778	13.39	14.825	16.08	17.207

(Source: Ovum Group, 9/98)

**Table A-5 U.S. VCR Sales**

<u>TOTAL VCR Sales to Dealers**</u>									
(in millions)	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>
Annual Sales	14.077	15.104	15.767	17.84	18.984	21.26	27.227	29.014	26.885
Cumulative Sales	14.077	29.181	44.948	62.788	81.772	103.032	130.259	159.273	186.158

\*\* Including VCR decks and TV/VCR Combinations.  
 Data Source: Consumer Electronics Association, 2001

**Table A-6 Sales of Color TV Receivers**

	Direct-view Color TV receivers								
(in millions)	1993	1994	1995	1996	1997	1998	1999	2000	2001
Annual Sales to Dealers (1)	23.005	24.715	23.231	22.384	21.293	22.204	23.218	23.776	23.901
Annual Color TV Sales with Projection TV (2)	23.470	25.351	24.051	23.271	22.210	23.274	24.450	25.236	25.121
Annual Color TV Sales with Projection TV and TV/VCR Combo (3)	25.099	27.368	26.256	25.470	24.521	26.421	28.868	30.245	30.401
(1) Excludes LCD, Projection TV, TV/VCR combinations									
(2) Data (1) plus Projection TV sales									
(3) Data (1) plus Projection TV and TV/VCR combination sales									
Data Source: Consumer Electronics Association, 2001									

**Table A-7 U.S. Direct Broadcast Satellite Subscribers**

	DBS Subscribers														
(in millions)	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
DBS Subscribers	0.587	2.273	4.425	6.421	8.866	11.440	14.896	18.2	20.8	23.1	25.1	26.9	28.5	29.9	31.2
Source: DBS Investor from the Canal Group, May 2001															

**Table A-8 U.S. Sales of Personal Computers**

	Personal Computers***								
(in millions)	1993	1994	1995	1996	1997	1998	1999	2000	2001
Annual Sales	5.85	6.73	8.40	9.40	11.00	12.80	14.90	16.40	17.50
Cumulative Sales	5.850	12.575	20.975	30.375	41.375	54.175	69.075	85.475	102.975
*** Sales through consumer channels, includes notebooks, does not include TV/PC combinations, average price includes monitors									
Data Source: Consumer Electronics Association, 2001									

**Table A-9 Average Price of U.S. Analog/Digital TV Set-top Receivers**

US Analog/Digital TV Set-top Receivers - Average Unit Manufacturer Price								
	1997	1998	1999	2000	2001	2002	2003	2004
Analog Cable	\$140	\$135	\$130	\$125	\$120	\$115	\$105	\$105
Digital Cable	\$377	\$335	\$300	\$265	\$255	\$270	\$280	\$280
Digital Satellite	\$225	\$220	\$190	\$180	\$175	\$170	\$160	\$155
Fixed Wireless Broadband	\$500	\$480	\$455	\$425	\$400	\$375	\$350	\$325
TV/Internet Digital Converters (or DTV/PC Card)	\$235	\$215	\$175	\$170	\$165	\$160	\$155	\$155

*Source: The Carmel Group; DBS Investor, June 2001*